Riparian Terminology: Confusion and Clarification

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January 2001

INTRODUCTION

Riparian zones occur throughout the United States as long strips of vegetation adjacent to streams, rivers, lakes, reservoirs, and other inland aquatic systems that affect or are affected by the presence of water. This vegetation contributes to unique ecosystems that perform a large variety of ecological functions. Unfortunately, considerable variation is associated with riparian terminology, similar to problems associated with wetlands terminology (Mitsch and Gosselink 1993). This can lead to confusion when people attempt to communicate about riparian zones, particularly if they come from different disciplinary backgrounds. The goals of this paper are to promote awareness of this problem by describing variation associated with semantics in riparian terminology, to explain why this contributes to confusion, to show the importance of attempting to standardize this terminology, and to suggest ways that natural resource professionals can better describe what comprises a riparian ecosystem.

WHY IS THERE CONFUSION?

No Universally Accepted Riparian Definition.

No single wetland definition appears to meet or satisfy the needs of all scientists or agencies. For example, Cowardin et al. (1979) defined wetlands and deepwater habitats for the National Wetlands Classification System and Inventory (NWI), whereas the U. S. Army Corps of Engineers uses a different definition under Section 404 of the Clean Water Act to regulate the deposition of dredged and fill materials into wetlands. Similarly, there is no universally recognized or widely accepted definition that adequately describes all riparian zones (Anderson 1987). Riparian definitions found in some texts are over-simplified, and some books on wildlife habitats and plant communities do not adequately distinguish riparian communities from upland communities (Ohmart and Anderson 1986).

Riparian definitions range from simple descriptions, such as "associated with water courses" (Dick-Peddie and Hubbard 1977:86), to technical and detailed descriptions for specific areas (e.g., Minshall et al. (1989)). Recently, Ilhardt et al. (2000; p. 29) proposed a more functional definition for riparian zones. They suggested that riparian zones are, "three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems, that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at a variable width." However, there is no indication that this or other recent definitions will become universally accepted as the standard.

Regional Differences.

Stream and river ecosystems differ regionally and locally in many characteristics, including width, depth, frequency of flooding, hydrogeomorphic factors, and vegetation. These differences are most apparent between Eastern and Western regions of the United States. Riparian zones in the arid West often occur on low-order streams having extreme and variable fluvial conditions (Mitsch and

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Gosselink 1993). In arid and semi-arid regions, there typically is a strong visual contrast between riparian and upland vegetation communities (Figure 1). Often, these streams are ephemeral, with steep gradients and narrow floodplains.

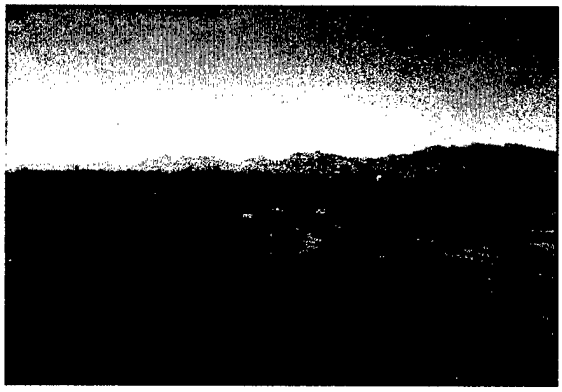

Figure 1. Riparian zones in the Western United States tend to be much narrower than in the East and contrast highly with surrounding uplands.

Riparian vegetation often consists of a lush mixture of trees, shrubs, and herbaceous vegetation, while adjacent upland areas are typically non-forested ecosystems such as grasslands and deserts. Stream and riparian ecosystems in this region often are referred to by a number of regional terms such as desert washes and bosques higher in the watershed, and cottonwood bottomlands and arroyos along larger river systems. Other Western riparian zones, such as those in the Rocky Mountains and the Pacific Northwest, are also very different from most Eastern systems. They typically occur along faster-moving systems that occur in deeply incised valleys. Many Midwestern riparian zones in agricultural-dominated landscapes are also very apparent on the landscape; these riparian zones are often called gallery forests.

The most extensive riparian zones in the United States are bottomland hardwood forests (BLH) that occur as vast forests along broad river floodplains or alluvial valleys in the Eastern, Southeastern, and Central United States (Huffman and Forsythe 1981, Mitsch and Gosselink 1993) (Figure 2). Unlike many Western riparian systems, both BLH and adjacent uplands frequently are dominated by deciduous hardwoods, making the riparian zone a less-conspicuous component of the landscape (Johnson and Lowe 1985).

Figure 2. Bottomland hardwoods, typically labeled as a floodplain forest, are a type of riparian community.

Lack of Consistent Terminology.
Riparian zones are studied and managed by a variety of individuals (e.g., landscape ecologists, urban planners, hydrologists, fisheries and wildlife biologists, agronomists, range managers, geomorphologists), who have developed and used their own specific terminology. This lack of consistency among different perspectives further heightens confusion regarding riparian definitions and terminology (Bennett et al. 1989, Gregory et al. 1991). For example, what constitutes a properly functioning riparian zone for water quality protection to an agronomist or hydrologist may be only a fraction of the land area that a wildlife ecologist considers adequate to provide habitat or a wildlife movement corridor among larger habitat patches (Fischer and Fischenich 2000).

Riparian literature from journal papers in a variety of ecological fields contains many terms describing vegetation adjacent to permanent and intermittent streams, rivers, lakes, wetlands, and other aquatic systems (Table 1), often without explicit definition. Although many of these terms can be informative and descriptive, they tend to be used interchangeably without any clear understanding as to whether they described

Table 1. Terminology from the Literature and Other Sources Describing Vegetation Located Adjacent to Aquatic Systems

Riparian floodplains	Riverfront hardwoods
Riparian-wetland areas	Alluvial swamp forests
Riparian forests	Buffer strips
Riparian zones	Streamside vegetation
Riparian swamps	Streamside forests
Riparian woodlands	Streamside management zones
Riparian corridors	Floodplain forest
Riparian ecosystems	Drainage-associated vegetation
Riparian sites	Hardwood stringers
Riparian wetlands	Swamp forest
Riparian mountain meadows	Cottonwood bottomlands
Riparian forest stands	Bottomland hardwood riparian ecosystems
Riparian ribbons	Bottomland hardwoods
Riverine bands	Desert arroyos
River margins	Mesquite bosques
Riverine floodplains	Hardwood bottoms
Riverine wetlands	Aquatic buffers
Gallery forests	Desert wash

[1] Terms from the Journal of Wildlife Management, Environmental Management, Wetlands, BioScience, Condor, Wilson Bulletin, Great Basin Naturalist, Journal of Range Management, Ecological Applications, Ecology, Canadian Journal of Fisheries and Aquatic Science, Proceedings of the Southeastern Association of Fish and Wildlife Agencies, Ecological Monographs, U.S. Forest Service General Technical Reports, U.S. Fish and Wildife Service Reports, and several books.

similar areas from structural, functional, and ecological perspectives.

Differences in Legal Protection.
Although techniques exist for delineating the landward boundary of wetlands (e.g., Environmental Laboratory (1987)), no such standardized techniques exist for riparian zones. Riparian zones often are referred to as wetlands, but these two terms are not necessarily synonymous (Ohmart and Anderson 1986, Ratti and Kadlec 1992). Jurisdictional wetlands, or those wetlands that meet the soil, vegetation, and hydrologic criteria in the "Corps of Engineers Wetlands Delineation Manual" (Environmental Laboratory 1987), can occur within a riparian zone, but may only represent a small portion of the total riparian area. Examples of jurisdictional wetlands occurring within the riparian zone include palustrine wetlands in the NWI (Cowardin et al. 1979) and riverine wetlands in Brinson (1993) (e.g., bottomland hardwoods in the Southeastern United States). However, many other riparian zones were not included in the NWI because they did not meet the criteria of these classification schemes, especially in most arid and semi-arid Western states (Johnson et al. 1984, Kusler 1985, Lowe et al. 1986).

Major portions of riparian zones are not classified as wetlands by the Corps, and therefore, often are not afforded legal protection under Section 404. However, vegetation, soils, and hydrologic processes that are unique from uplands, but do not meet the criteria of current wetlands definitions, regularly occur in riparian zones. These areas are still functionally unique when compared to the adjacent upland habitats (Johnson et al. 1984, Debano and Schmidt 1989), yet they do not receive Federal protection as jurisdictional wetlands.

WHY IS CONSISTENT TERMINOLOGY IMPORTANT?

Protecting Riparian-Dependent Species. Consistent terminology and a more universally accepted riparian definition could improve guidance for delineating riparian zones for the conservation of fish and wildlife populations. Although riparian habitats comprise a very small proportion of most landscapes, they frequently are used by wildlife in much greater proportion to their availability. Riparian zones in the Western United States comprise less than 1 percent of the total land area, yet these areas are used by more species of breeding birds than any other habitat in North America (Knopf et al. 1988). Thomas et al. (1979) reported 285 of 378 (75 percent) terrestrial species either required riparian zones year-round or were directly dependent on them for a portion of their life cycle. Approximately 190 species of North American amphibians are dependent on wetland breeding habitat (Clark 1979), and many of these wetlands occur in riparian zones. Riparian buffer strips are also very important for maintaining quality habitat for fish and other aquatic organisms (Large and Petts 1994).

Riparian habitats are extremely important for some rare, endangered, and endemic species. For example, Brinson et al. (1981) suggested that of the 276 species listed as threatened or endangered by the United States Fish and Wildlife Service (USFWS) in 1980, at least 80 (29 percent) were partially dependent on riparian habitats. Mismanagement of BLH has been implicated as a primary cause for the extinction of the ivory-billed woodpecker (*Campephilus principalis*) and Carolina parakeet (*Conuropis carolinensis*) (Harris and Gosselink 1990). The Southwestern willow flycatcher (*Empidonax traillii extimus*), which breeds in riparian habitats of the Southwest, is now listed as endangered by the USFWS because of large-scale loss of riparian habitat (USFWS 1995, Sogge et al. 1997). Other riparian-obligate birds that have experienced significant population declines due to loss of riparian habitat include the swallow-tailed kite (*Elanoides forficatus*) in the Southeast, and least Bell's vireo (*Vireo bellii pusillus*) (Guilfoyle and Wolters, in preparation) and yellow-billed cuckoo (*Coccyzus americanus*) in the Southwest (Olson and Gray 1989).

Quantifying Riparian Habitat Loss. Many of the existing riparian zones, including associated wetlands and aquatic systems, suffer greatly from a variety of land-use practices, especially overgrazing, timber removal, flood-control, and nonpoint-source pollution. Riparian zone destruction has varied regionally in the United States, with Southeastern and Southwestern states probably receiving the greatest impact. For example, approximately 90 percent of Arizona and New Mexico's original riparian ecosystems have disappeared (Brinson et al. 1981). Similar estimates have been made for BLH in the Southeast (Haynes and Moore 1988).

Because guidance on delineating the boundaries of wetlands is much clearer, better estimates are available for the loss of wetland habitat. Despite the fact that major losses of riparian habitats have occurred, Brinson et al. (1981) suggested there was little work done in the United States to determine original and current riparian land area. They suggested that only 4-6 million ha of intact natural-riparian communities remained in the United States in the early 1980's. This and other estimates are highly dependent on how much streamside land area was included as riparian land. Past efforts to identify the historical extent of riparian vegetation have undoubtedly been hampered by a lack of consistency in terminology. Finally, because wetlands often comprise a portion of the riparian zone, separate loss estimates for wetlands and riparian zones are not always additive.

RECOMMENDATIONS AND CONCLUSIONS

Because of the diverse background of persons interested in riparian zones, standard terminology and classification schemes are critical to providing consistency. Cowardin (1982) attempted to standardize some of the semantic problems occurring in the wetlands literature, and there is a similar need for scientists to agree on standard terminology when discussing riparian systems. Until natural

resource professionals can agree on a definition of riparian zones and exactly what constitutes a riparian zone (e.g., what is its landward boundary), it will be difficult to manage these systems for the range of functions that they provide. Accomplishing these goals may aid future comparisons of riparian status and trends, and possibly provide a better chance for protection of riparian systems that occur in the arid and semi-arid Western United States. Riparian zones in the Southwestern United States may not be as "wet" as those of the Eastern United States, but they play an equally important role in providing wildlife and fisheries habitat, wildlife movement corridors, erosion control, and nonpoint-source pollution control. Kusler (1985) suggested all riparian zones should be designated as a class of lands similar to and as valuable as wetlands, but not meeting the strict wetlands definitions. Riparian zones should be better recognized as unique, functional ecosystems that need better legal protection similar to wetlands.

Using specialized descriptor terms for riparian vegetation (e.g., river margins, streamside forests, hardwood stringers) should be reduced, and the term "riparian" should be used whenever possible as the primary descriptor when referring to transitional areas between aquatic and upland habitats. Other terms with regional significance could be used in conjunction with riparian as a secondary descriptor term (e.g., riparian gallery forest, riparian mesquite bosque). In addition, authors should provide a detailed description of the riparian vegetation structure and composition to assist readers in better understanding the type of system in question. Consistent terminology, and the use of "riparian" as a keyword in journal articles and other papers, will also aid literature reviews for papers addressing riparian research and management. Finally, Federal and state agencies should cooperate in an attempt to adopt a universal riparian definition and classification that is compatible with current wetland-classification systems.

The authors hope that this technical note stimulates further discussion and promotes awareness of current terminology problems. The authors also hope to reduce the confusion in riparian terminology that exists in the literature and among professionals. Additional information on riparian zone ecology and management can be obtained by contacting Dr. Richard A. Fischer, CEERD-EE-E, fischer@wes.army.mil or (601) 634-3983.

ACKNOWLEDGMENTS

This study was supported by the Ecosystem Management and Restoration Research Program, U.S. Army Engineer Research and Development Center, Waterways Experiment Station (WES). This manuscript benefited greatly from discussions with Sammy King and George Hess. We thank Dr. Ellis J. Clairain, Sammy L. King, Fritz L. Knopf, and Kirk Lohman for helpful reviews of this manuscript. WES technical reviews were provided by Drs. L. Jean O'Neil and H. Roger Hamilton, and Mr. Michael P. Guilfoyle, of the Environmental Laboratory, ERDC-EL.

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> Fischer, R. A., Martin, C. O, Ratti, J. T., and Guidice, J. (2000). "Riparian Terminology: Confusion and Clarification," (ERDC TN-EMRRP-SR-25), U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/emrrp

REFERENCES

Anderson, E. W. (1987). "Riparian area definition-- a viewpoint," *Rangelands* 9,70.

Bennett, P. S., Kunzmann, M. R., and Johnson, R. R. (1989). "Relative nature of wetlands: Riparian and vegetational considerations." *Proceedings of the California riparian systems conference: Protection, management, and restoration for the 1990's.* D. L. Abell, tech. coord., U.S. Forest Service General Technical Report PSW-110, 140-142.

Brinson, M. M. (1993). "A hydrogeomorphic classification for wetlands," Technical Report WRP-DE-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Brinson, M. M., Swift, B. L., Plantico, C., and Barclay, J. S. (1981). "Riparian ecosystems: Their ecology and status," U.S. Fish and Wildl. Service Report FWS/OBS-81/17.

Clark, J. E. (1979). "Freshwater wetlands: Habitats for aquatic invertebrates, amphibians, reptiles, and fish." *Wetland functions and values: The state of our understanding.* P. E. Greeson, J. R. Clark, and J. E. Clark, eds. American Water Resources Association, Minneapolis, MN, 330-343.

Cowardin, L. M. (1982). "Some conceptual and semantic problems in wetland classification and inventory," *Wildlife Society Bulletin* 10, 57-60.

Cowardin, L. M., Carter, V., Golet, F. C., and LaRoe, E.T. (1979). "Classification of wetlands and deepwater habitats of the United States," U.S. Fish and Wild. Service Publ. FWS/OBS-79-31.

Debano, L. F., and Schmidt, L. J. (1989). "Improving southwestern riparian areas through watershed management," U.S. Forest Service General Technical Report RM-182, Ft. Collins, CO.

Dick-Peddie, W. A., and Hubbard, J.P. (1977). "Classification of riparian habitat in the Southwest." *Importance, Preservation and Management of Riparian Habitat: A Symposium*. R. R. Johnson, and D. A. Jones, tech. coords., U.S. Forest Service General Technical Report RM-43, Tucson, AZ, 85-90.

Environmental Laboratory. (1987). "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Fischer, R. A., and Fischenich, J.C. (2000). "Design recommendations for riparian corridors and vegetated buffer strips," EMRRP Technical Notes Collection (TN EMRRP-SR-24), U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Gregory, S. V., Swanson, F. J., McKee, W. A., and Cummins, K. W. (1991). "An ecosystem perspective of riparian zones," *BioScience* 41, 540-551.

Guilfoyle, M. P., and Wolters, M. S. "Western riparian songbirds potentially impacted by USACE reservoir operations," EMRRP Technical Notes Collection, in preparation, U.S. Army Engineer Research and Development Center, Vicksburg, MS. www.wes.army.mil/el/emrrp.

Harris, L. D., and Gosselink, J. G. (1990). "Cumulative impacts of bottomland hardwood forest conversion on hydrology, water quality, and terrestrial wildlife." *Ecological processes and cumulative impacts: Illustrated by bottomland hardwood wetland ecosystems.* J. G. Gosselink, L. C. Lee, and T. A. Muir, eds. Lewis Publishers, Inc., Chelsea, MI, 259-322.

Haynes, R. J., and Moore, L. (1988). "Reestablishment of bottomland hardwoods within National Wildlife Refuges in the southeast." *Increasing our wetland resources. Proceedings of a Conference of the National Wildlife Federation, Washington, DC.* J. Zelazny and J. S. Feierabend, eds., 95-103.

Huffman, R. T., and Forsythe, S. W. (1981). "Bottomland hardwood forest communities and their relation to anaerobic soil conditions." *Wetlands of bottomland hardwood forests.* J. R. Clark and J. Benforado, eds., Elsevier, Amsterdam, 187-196.

Ilhardt, B. L., Verry, E. S., and Palik, B. J. (2000). "Defining riparian areas." *Riparian management in forests of the continental eastern United States.* E. S. Very, J. W. Hornbeck, and C. A. Doloff, eds. Lewis Publishers, New York, 23-42.

Johnson, R. R., Carothers, S. W., and Simpson, J. M. (1984). "A riparian classification system." *California riparian systems.* R. E. Warner and K. M. Hendrix, eds., University of California Press, Berkeley, 375-382.

Johnson, R. R., and Lowe, C.H. (1985). "On the development of riparian ecology." *Riparian ecosystems and their management: Reconciling conflicting uses.* R. R.Johnson, C. D. Ziebell, D. R. Patton, P. F. Ffolliott, and R. H. Hamre, tech. coords., U.S. Forest Service General Technical Report RM-120, Ft. Collins, CO, 112-116.

Knopf, F. L., Johnson, R.R., Rich, T., Samson, F.B., and Szaro, R.C. (1988). "Conservation of riparian ecosystems in the United States," *Wilson Bulletin* 100, 272-284.

Kusler, J. (1985). "A call for action: Protection of riparian habitat in the arid and semi-arid West." *Riparian ecosystems and their management: Reconciling conflicting uses.* R. R. Johnson, C. D. Ziebell, D. R. Patton, P. F. Ffolliott, and R. H. Hamre, tech. coords., U.S. Forest Service General Technical Report RM-120, Ft. Collins, CO, 6-8.

Large, A. R. G., and Petts, G. E. (1994). "Rehabilitation of river margins." *The Rivers Handbook, Volume Two.* P. Calow and G. E. Petts, eds., Blackwell Scientific Publishers, 401-437.

Lowe, C. H., Johnson, R. R., and Bennett, P. S. (1986). "Riparian lands are wetlands: The problem of applying eastern American concepts and criteria to environments in the North American southwest." *Hydrology and water resources in Arizona and the southwest. Proceedings of the American Water Resources Associations, Arizona Section.* Tucson, AZ, 89-100.

Minshall, G. W., Jensen, S. E., and Platts, W. S. (1989). "The ecology of stream and riparian habitats of the Great Basin region: A community profile," U.S. Fish and Wildlife Service Biological Report 85(7.24).

Mitsch, W. J., and Gosselink, J. G. (1993). *Wetlands.* 2nd ed. Van Nostrand Reinhold, New York.

Ohmart, R. D., and Anderson, B.W. (1986). "Riparian habitats." *Inventory and monitoring of wildlife habitat.* A. Y. Cooperrider, R. J. Boyd, and H. R. Stuart, eds., U.S. Bureau of Land Management Service Center, Denver, CO, 169-199.

Olson, T. E., and Gray, M. V. (1989). "Characteristics of least Bells vireo nest sites along the Santa Ynez River." *California Riparian Systems Conference: Protection, management, and restoration in the 1990's.* D. L. Abell (tech. coord.), U.S. Forest Service General Technical Report PSW-110, 278-284.

Ratti, J. T., and Kadlec, J. A. (1992). "Concept plan for the preservation of wetland habitat of the Intermountain West," U.S. Fish and Wildlife Service, Region 1, Portland, OR.

Sogge, M. K., Marshall, R. M., Sferra, S. J., and Tibbitts, T. J. (1997). "A southwestern willow flycatcher natural history summary and survey protocol," U.S. Department of the Interior, National Park Service, Technical Report NPS/NAUCPRS/NRTR-97/12.

Thomas, J. W., Maser, C., and Rodiek, J. E. (1979). "Riparian zones." *Wildlife habitats in man-aged forests: The Blue Mountains of Oregon and Washington.* J. W. Thomas, tech. ed. U.S. Forest Service Agric. Handbook No. 553, Washington, DC, 40-47.

U.S. Fish and Wildlife Service. (1995). "Final rule determining endangered status for the southwestern willow flycatcher." *Federal Register* 60:10694.